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ALGAL PERIODICITY IN A SPRING

FAZLI MALIK SARIM, QAISAR ALI AND MOHAMMAD ANWAR JAVED

Department of Botany, University of Peshawar, Peshawar, Pakistan

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Periodicity of algae was studied in a spring ecosystem having constant physical and chemical properties. Forty seven species of algae belonging to 33 genera of three algal groups, Chlorophyceae, Bacillariophyceae and Cyanophyceae were recorded from the spring.

Key words: Priodicity, Spring, Algal

Introduction

An attempt has been made to study distribution of algae in various seasons round the year, in a spring ecosystem, having a medium, with constant physical and chemical properties.

The spring understudy, "Jan's" spring is on Shami Road, Peshawar City and has muddy bottom and very clear water. The surface of the spring is 25x14 feet and is 20 feet deep protected by a parameter.

Materials and Methods

Collections in each season were made by plankton net and samples were centrifuged for taxonomical studies. The diatom species were studied after boiling the centrifuged material in concentrated nitric acid and then washing the residue with distilled water. All the species have been supported by Camera Lucida drawings, (Plate 1-4).Water

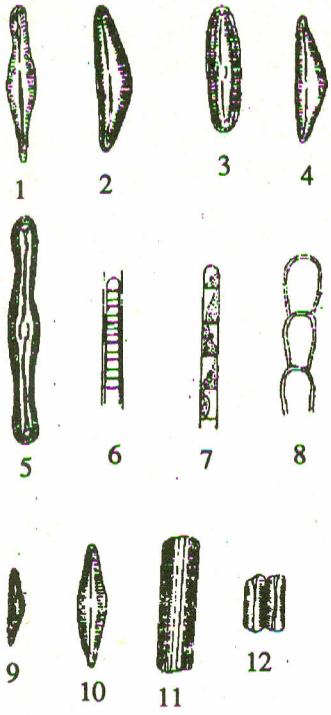
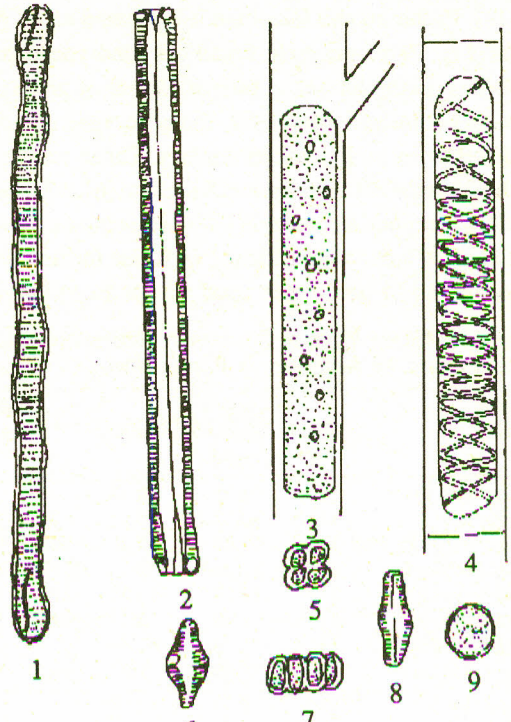


Plate No. 1

(1) *Gomphonema intricatum*, (2) *Cymbella parva*, (3) *Caloneis alpestris*, (4) *Cymbella laevis*, (5) *Pinnularia tabellaria* , (6) *Phormidium purascens*, (7) *Ulothrix variabilis*, (8) *Oedogonium sp.*, (9) *Cymbella affinis*, (10) *Gomphonema gracile var. dichotama*, (11) *Epithemia zebra*, (12) *Fragillaria construens*.

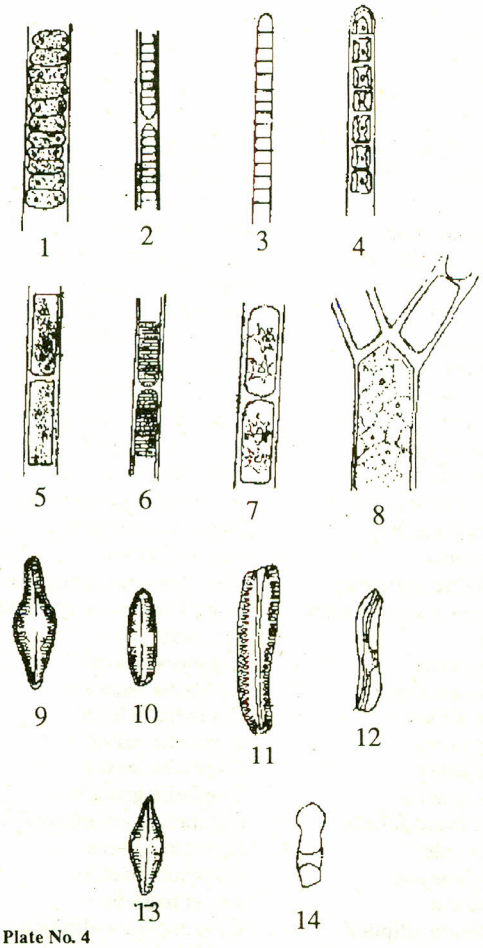


Contents - Plate No. 2

(1) *Eunotia flexuosa*, (2) *Synedra ulna*, (3) *Basicladia chelonum*, (4) *Spirogyra sp.*, (5) *Protococcus viridis*, (6) *Achnanthes Lanceolata*, (7) *Scenedesmus bijuga*, (8) *Navicula seminulum*, (9) *Chlorococcum humicola*

Contents - Plate No. 3

(i) *Cocconeis pediculus*, (2) *Diatoma hiemale*, (3) *Diploneis puella*, (4) *Achnanthes lanceolata*, (5) *Cymatopleura elliptica*, (6) *Cymbella lacustris*, (7) *Gomphonema angustatum*, (8) *Amphora ovalis*, (9) *Cymbella gracilis*, (10) *Cymbella cymbiformis*, (11) *Gomphonema acuminatum*, (12) *Surirella linearis var constricta*.



Contents – Plate No. 4

(1) *Ulothrix tenuissima*, (2) *Phormidium anomala*, (3) *Oscillatoria chlorina*, (4) *Microspora quadrata*, (5) *Rhizoclonium hieroglyphicum*, (6) *Phormidium ambigna*, (7) *Zygnema sp.*, (8) *Cladophora glomerata*, (9) *Navicula rhyncocephala*, (10) *Caloneis bacillum*, (11) *Rhoicosphenia curvata*, (12) *Gyrosigma scalproides*, (13) *Stauroneis anceps*, (14) *Cosmarium moniliforme*

samples were collected at three points, and at each point from surface, at the depth of one and two meters and mixed in a bottle to make a representative sample.

Results and Discussion

Forty seven species of algae belonging to 33 genera of three algal groups, Chlorophyceae, Bacillariophyceae and Cyanophyceae were recorded from the Spring.

Chlorophyceae with 13 species, Bacillariophyceae with 30 and Cyanophyceae with only 4.

In respect of species number, Diatoms were dominant, throughout the year, in all the four seasons as they are hardy and perennial. The seasonal distribution of algae in the spring is given in Table 1. The physical and chemical properties of the water is given in Table 2. which remains the same with the temperature of the water remaining at 22.5 ± 1° throughout the year. So on the basis of physical and chemical properties, the present spring is also a large natural chemostat. The only variable was the sunlight which is responsible for the various changes of algal species.

Cold spring are usually rich in calcium and bicarbonate ions and the flora is generally that of alkaliphillio. So the species present in the spring understudy are the hard water, type as it supports more algae growth [6], whereas soft water or acid water are spared. In the present study there are no CO_3 but HCO_3 are 340 ppm and total hardness (Ca+Mg) is 368 ppm.

The periodicity of the seasonal growth of algae is often attributed to effects of temperature, but is very doubtful if such influences can be entirely diverced from these of light and certain mineral salts [1]. It has been mentioned by Macan [5] that the content of calcium is one of the biggest, on which can be based a division and it being frequently possible to distinguish hard water and soft water species.

Table 1. Distribution of Species During four Seasons

Spring	Summer	Autumn	Winter
		1. Green Alga	
1. *Ulothrix variabilis*	*Ulothrix variabilis*	*Ulothrix variabilis*	*Ulothrix variabilis*
2.		*Ulothrix tenuissium*	
3.		*Microspora quardata*	*Miscrospora quardata*
4.	Protococcus viriel		
5.	Cladophora glomerata		
6.			Rhizoclonium nierozlyphicum
7.	Basicladia chelonum		
8. Oedogonium sp.	Oedogonium sp.		
9.	Chlorococcum humicola		
10.	Scenedesmus bijuga		
11. Spirogyra sp.	Spirogyra sp.		
12.			Zygnema sp.
13.			Cosmarium moniliforme
		2. Diatom	
1. Synedra ulna	Synedra ulna	Synedra ulna	Synedra ulna
2. Diatoms hiemale	Diatoms hiemale	Diatoma hiemale	Diatoma hiemale
3. Fragilaria construens	Fragilaria construens	Fragilaria construens	Fragilaria construens
4. Eunotia flexuosa	Eunotia flexuosa	Eunotia flexuosa	Eunotia flexuosa

Contd. table 1.

Contd. table 1.

Spring	Summer	Autumn	Winter
5. Achnanthes lanceolata	Achnanthes lanceolata	Achnanthes lanceolata	Achnanthes lanceolata
6. Achnanthes lanceolata var. rostrata	Achnanthes lanceolata var. rostrata	Achnanthes lanceolata var. rostrata	Achnanthes lanceolata var. rostrata
7. Cocconeis pediculus	Cocconeis pediculus	Cocconeis pediculus	Cocconeis pediculus
8. Rhoicosphenia curvata	Rhoicosphenia curvata	Rhoicosphenia curvata	Rhoicosphenia curvata
9. Caloneis alpestris	Caloneis alpestris	Caloneis alpestris	Caloneis alpestris
10. Caloneis bacillum	Caloneis bacillum	Caloneis bacillum	Caloneis bacillum
11. Diploneis puella	Diploneis puella	Diploneis puella	Diploneis puella
12. Gyrosigma scalproide	Gyrosigma scalproide	Gyrosigma scalproide	Gyrosigma scalproide
13. Navicula seminulum	Navicula seminulum	Navicula seminulum	Navicula seminulum
14. Navicula rhyncocephala	Navicula rhyncocephala	Navicula rhyncocephala	Navicula rhyncocephala
15. Stauroneis anceps	Stauroneis anceps	Stauroneis anceps	Stauroneis anceps
16. Pinnularia tabellaria	Pinnularia tabellaria	Pinnularia tabellaria	Pinnularia tabellaria
17. Gomphonema angustatum	Gomphonema angustatum	Gomphonema angustatum	Gomphonema angustatum
18. Gomphonema gracile var. dichotoma	Gomphonema gracile var. dichotoma	Gomphonema gracile var. dichotoma	Gomphonema gracile var. dichotoma
19. Gomphonema intricatum	Gomphonema intricatum	Gomphonema intricatum	Gomphonema intricatum
20. Gomphonema acuminatum var. turris	Gomphonema acuminatum var. turris	Gomphonema acuminatum var. turris	Gomphonema acuminatum var. turri
21. Amphora ovalis	Amphora ovalis	Amphora ovalis	Amphora ovalis
22. Cymbella lacustric	Cymbella lacustric	Cymbella lacustric	Cymbella lacustric
23. Cymbella affinis	Cymbella affinis	Cymbella affinis	Cymbella affinis
24. Cymbella parva	Cymbella parva	Cymbella parva	Cymbella parva
25. Cymbella leavis	Cymbella leavis	Cymbella leavis	Cymbella leavis
26. Cymbella gracilis	Cymbella gracilis	Cymbella gracilis	Cymbella gracilis
27. Cymbella cymbiformis	Cymbella cymbiformis	Cymbella cymbiformis	Cymbella cymbiformis
28. Epithemia zebra	Epithemia zebra	Epithemia zebra	Epithemia zebra
29. Surisrrela linearis var. constricta	Surisrrela linearis var. constricta	Surisrrela linearis var. constricta	Surisrrela linearis var. constricta
30. Cymatopleura elliptica	Cymatopleura elliptica	Cymatopleura elliptica	Cymatopleura elliptica
		Blue green	
1.		Oscillatoria chlorina	
2. Phormidium ambigum			Phormidium ambigum
3.		Phormidium purascens	
		Phormidium purascens	

TABLE 2. PHYSICAL AND CHEMICAL PROPERTIES OF THE WATER

	Properties	Amount
1.	*Temperature*	22.5±1°
2.	Hydrogen concentration	8 pH
3.	Carbonate	Nil
4.	Biocarbonate	340 ppm
5.	Total Hardness (Ca+Mg)	368 ppm
6.	Calcium	168 ppm
7.	Magnesium	200 ppm
8.	Electrical conductivity	7.5 x 10^2 ohms
9.	Potassium	4.3 ppm
10.	Nitrate	8.5 ppm
11.	Nitrate	Nil
12.	Total Dissolved solids	350 ppm
13.	Sodium	24 ppm
14.	Chloride	12 ppm
15.	Dissolved Oxygen	8 ppm
16.	Sulphate	170 ppm
17.	Phosphate (Inorganic Phosphorous)	0.6 ppm
18	Iron	0.4 ppm
19.	Silica	2.4 ppm

The diatoms are not effected by the intensity of light, but they are effected by temperature and present through-out the year due to the constant temperature of the water. It is a common practice that blue greens usually respond to high summer temperature. But in the present study it is very strange that no blue green was present during summer.

The seasonal distribution of the member of Chlorophyceae from in this spring shows (Table 2.) that they are probably eucrytopic. The protoplasm of most blue green species is highly proteinaceous and require greater amount of nitrates than green algae. The water under-study has nitrates in traces, which may be the reason that only 4 species of blue green algae, *Oscillatoria chlorina*, *Phormidium ambigum*, *Phormidium anomala* and *P. parascens*, were collected. These blue green species, surviving at very minimum quantities of nitrogen may have lesser amount of proteins in their protoplasms, hence their requirements for nitrates is much lesser than that of other blue green algae.

It has been observed that for algae phosphorus is more critical than nitrogen in determining phytoplankton

production. It is also important in that it, in turn, facilitate the assimilation of nitrogen. But it is astonishing that the amount of phosphate present in the spring water is only 0.6 ppm and is responsible for all the algal growth. Similarly the amounts of oxygen, iron and silica are also very low and are 8.0 ppm, 0.4 ppm and 2.4 ppm respectively.The algae present in the spring water with this much small amounts of oxygen, iron and silica survive due to the absorption of atmospheric oxygen by water, which compensates the low amount of dissolved elements. In a spring algae continuously receive fresh nutrients, due to continuous change or runs off of water.

Conclusion

(i) The periodicity in the spring water is due to light as the temperature and nutrients remains same throughout the year.

(ii) These algae need little nitrogen and phosphorus.

(iii) Diatoms dominate because, they are hardy and perennial.

(iv) The algae survive at extremly small amounts of nutrients due to continuous supply of fresh water.

(v) These algae possibly form a community.

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